

## CLAIMS

We claim:

1. A control system for a cooling system having a compressor and a valve, said control system comprising:

a first sensor for sensing a property indicative of demand for cooling; and

a controller coupled to said sensor and operable to produce a variable duty cycle control signal in response to said property, said controller causing said compressor and said valve to vary a cooling capacity of the cooling system in response to said variable duty cycle control signal.

2. The control system of claim 1 wherein said sensor senses pressure and wherein said controller produces said variable duty cycle control signal with a variable cycle time that is a function of fluctuations in sensed pressure.

3. The control system of claim 1 wherein said first sensor is a temperature sensor.

4. The control system of claim 1 further comprising pressure sensor coupled to said controller.

5. The control system of claim 1 wherein said first sensor is a temperature sensor and further comprising a pressure sensor coupled to said controller.

6. The control system of claim 1 wherein said first sensor senses a property having a first rate of change and wherein said control system further comprising second sensor that senses a second property having a second rate of change, said second rate of change being substantially greater than said first rate of change.

7. The control system of claim 6 wherein said first sensor senses changes in temperature and wherein said second sensor senses changes in pressure.

8. The control system of claim 1 wherein said controller varies said cooling capacity by selectively rendering compressing members of the compressor effective and ineffective.

9. The control system of claim 1 wherein controller provides said variable duty cycle control signal that cycles at a cycle time shorter than the time constant of the load.

10. The control system of claim 1 wherein said first controller varies said cooling capacity between substantially one hundred percent capacity and substantially zero percent capacity.

11. The control system of claim 1 further comprising a diagnostic module for comparing said duty cycle with a value indicative of a system condition.

12. The control system of claim 11 further comprising an alert module responsive to said diagnostic module for issuing an alert signal when said duty cycle bears a predetermined relationship to said value.

13. The control system of claim 1 wherein said valve is a suction-side pressure regulator.

14. The control system of claim 1 wherein said valve is a liquid-side expansion valve.

15. The control system of claim 1 wherein said valve is a pulsing solenoid valve.

16. The control system of claim 1 wherein said valve is a stepper valve.

17. A cooling system comprising,  
a refrigeration case;  
an evaporator disposed in said case;  
a condenser in fluid communication with said evaporator;  
a valve in fluid communication with said evaporator and said condenser;  
a pulse-width-modulated variable capacity compressor in fluid communication with  
said condenser, said evaporator, and said regulator;  
a first sensor for sensing a property indicative of a demand for cooling; and  
a controller responsive to said first sensor and providing a variable duty cycle control  
signal to said compressor to modulate a compressor capacity and to modulate said valve  
to a valve position, wherein an operating capacity of the cooling system is adjusted to its  
thermal load.

18. The cooling system of claim 17 further comprising a second refrigeration case  
having a second evaporator disposed therein, said second evaporator being coupled in  
fluid communication with said condenser.

19. The cooling system of claim 17 wherein said first sensor is a temperature  
sensor.

20. The cooling system of claim 17 wherein said controller produces said variable  
duty cycle control signal with a variable cycle time that is a function of fluctuations in  
pressure.

21. The cooling system of claim 17 further comprising a pressure sensor coupled to said controller.

22. The cooling system of claim 17 wherein said valve includes a stepper motor.

23. The cooling system of claim 17 wherein controller provides said variable duty cycle control signal that cycles at a cycle time shorter than the time constant of the load.

24. The cooling system of claim 17 wherein said controller varies cooling capacity between substantially one hundred percent capacity and substantially zero percent capacity.

25. The cooling system of claim 17 wherein said compressor is selectively operable in at least two states, said compressor comprising a pair of fluid compressing members and including a first state corresponding to a first capacity wherein said pair of fluid compressing members are separated by a seal and a second state corresponding to a second capacity lower than said first capacity wherein said seal between said pair of fluid compressing members is broken.

26. The cooling system of claim 25 wherein said compressor pumps a refrigerant under pressure and wherein said controller produces said control signal with a variable cycle time that is a function of fluctuations in refrigerant pressure.

27. The cooling system of claim 25 wherein said compressor includes fluid compressing members and mechanism for selectively rendering said compressing members effective and ineffective to thereby assume said first state and said second state, respectively.

28. The cooling system of claim 25 wherein said compressor includes an electric motor and wherein said compressor is configured such that said electric motor remains energized in said first and second states.

29. The cooling system of claim 17 wherein said first sensor senses a property having a first rate of change and wherein said control system further comprising second load sensor that senses a second property having a second rate of change, said second rate of change being substantially greater than said first rate of change.

30. The cooling system of claim 29 wherein said load sensor senses changes in temperature and wherein said second load sensor senses changes in pressure.

31. The cooling system of claim 17 wherein said compressor has two mechanical elements separated by a seal, said mechanical elements being movable relative to one another to develop fluid pressure and wherein said compressor includes mechanism to selectively break said seal in response to said control signal to thereby alter said fluid pressure developed while allowing said mechanical elements to maintain substantially constant relative movement with one another.

32. The cooling system of claim 17 wherein said compressor is a scroll compressor.

33. The cooling system of claim 17 wherein said controller produces a control signal that cycles at a cycle time at least four times shorter than the time constant of the load.